The National Research Initiative Competitive Grants Program in animal reproduction: Changes in priorities and scope relevant to United States animal agriculture

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The National Research Initiative Competitive Grants Program in animal reproduction: Changes in priorities and scope relevant to United States animal agriculture

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ABSTRACT: The National Research Initiative (NRI) Competitive Grants Program is the USDA's major competitive grants program and is administered by the Cooperative State Research, Education, and Extension Service. The NRI was authorized by the US Congress in the 1990 Farm Bill at a funding level of $500 million; however, the maximal NRI appropriation was $181.17 million in fiscal year (FY) 2006. Across all programs, the NRI is mandated to use 40% of its funding to support mission-linked research. Since its inception in 1991, the NRI has funded competitive grants in the discipline of animal reproduction. Before 2004, the Animal Reproduction Program funded a broad range of projects encompassing almost every subdiscipline in reproductive biology of farm animals, including aquatic species important to the aquaculture industry and laboratory animals. During FY 2004, the NRI Animal Reproduction Program narrowed the focus of its funding priorities to 5 issue-based topics in an effort to make greater measurable improvements in a few high-impact areas over the next 10 years. Funding priorities were narrowed further in FY 2006 to 3 subdisciplines based, in part, on recommendations that emerged from a stakeholder workshop conducted by Cooperative State Research, Education, and Extension Service in August 2004. In FY 2003, Congress authorized expenditure of up to 20% of the funds appropriated to the NRI to support projects that integrate at least 2 of the 3 functions of research, education, and extension. In FY 2004, the Animal Reproduction Program included a funding priority for integrated projects focused primarily on infertility in dairy cattle. The program funded its first integrated project in FY 2005. During FY 2002, increased emphasis on justification for the use of model systems (e.g., laboratory animals and in vitro systems) was included in the NRI request for applications. In FY 2006, applications proposing to primarily utilize nonagricultural animal models were excluded from the program. Currently, all proposed studies must be thoroughly justified in terms of their relevance to US animal agriculture and to program priorities identified within the request for applications.

Key words: animal, aquaculture, competitive grant, federal funding, reproduction

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INTRODUCTION

The National Research Initiative (**NRI**) Competitive Grants Program is the major competitive grants program within the USDA and is administered by the Cooperative State Research, Education, and Extension Service (**CSREES**). The NRI Animal Reproduction Program is essentially the only competitive grants program in the federal government that supports basic and applied research to enhance reproductive efficiency in livestock, poultry, and aquaculture species or to inhibit reproductive activity in meat-producing species. Funding is available from the National Institutes of Health for research with agricultural animals; those research projects must utilize agricultural species as biomedical models for studies related to human health.

Since fiscal year (**FY**) 2000, the NRI Animal Reproduction Program has undergone numerous important changes. These include changes in the program's priorities and scope in attempt to increase the relevance of the program to animal agriculture within the United States. An overarching reason for implementing these

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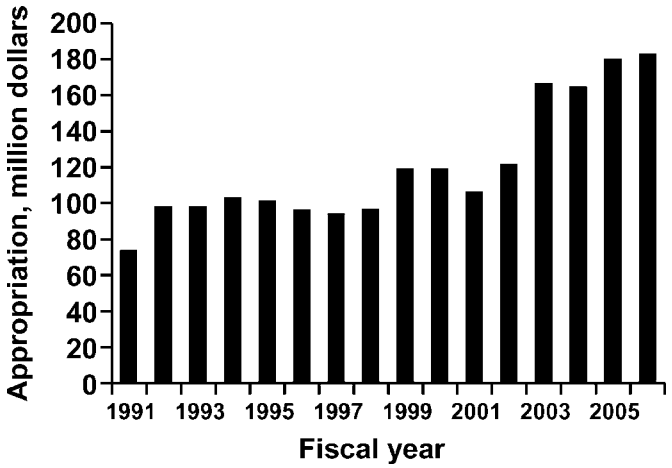

Figure 1. Total Congressional appropriations to the National Research Initiative Competitive Grants Program from fiscal years 1991 through 2006.

changes was to make greater progress in solving national and regional problems affecting animal agriculture and aquaculture. Whereas the overwhelming majority of projects funded previously by this program were relevant to animal agriculture, some funded projects clearly had a greater degree of relevance than other projects. Additionally, the fundamental nature of much of the research supported by the Animal Reproduction Program decreased the near-term applicability of the discoveries resulting from this research. This paper summarizes those changes and presents the rationale for instituting these modifications. As background information, a brief historical overview of the NRI and the Animal Reproduction Program also is provided.

CONGRESSIONAL AUTHORIZATION AND APPROPRIATION OF FUNDING

The US Congress authorized the NRI at a funding level of $500 million in the 1990 Farm Bill; however, Congress has never appropriated the maximal level of authorized funding. Only in recent years has Congressional appropriation to the NRI approached $200 million (Figure 1), of which approximately $4 million is allocated annually to support competitive grants within the Animal Reproduction Program. In FY 2006, the NRI supported more than 30 individual programs in animal production and protection, plant production and protection, pest biology, human nutrition, food safety, rural development, and natural resources and the environment. Based on Congressional appropriations and historical administration of the NRI, increased Congressional funding appropriations to the NRI have generally been allocated to the creation of new NRI programs rather than to increased funding for existing programs.

CHANGES IN PROGRAM NAME

The Animal Reproduction Program previously was named Animal Reproductive Efficiency (FY 1998 to 2000) and Enhancing Animal Reproductive Efficiency (before FY 1998). In FY 2001, the name of the program was changed to Animal Reproduction. This change reflected the fact that the program now would be evaluating applications that proposed to control reproduction rather than only those directed toward increasing reproductive efficiency. For example, applications that proposed to develop improved methods of sterilization or monosex populations of meat-producing animals would be considered by the program. Previously, those proposals were evaluated by the NRI Animal Growth and Nutrient Utilization Program because development of these approaches did not improve reproductive efficiency and those proposals typically were justified from the standpoint of increased growth efficiency of the animals targeted by the approach.

RELEVANCE TO ANIMAL AGRICULTURE

Relevance of a proposed project to improvements in and sustainability of US animal agriculture is 1 of the 3 main review criteria for evaluation of applications submitted to the Animal Reproduction Program (USDA, 2007). The other 2 review criteria are 1) scientific merit and 2) qualifications of project personnel, adequacy of facilities, and project management (USDA, 2007). These criteria are utilized by a review panel of peer scientists, educators, and industry representatives to evaluate and rank each application relative to all other proposals submitted to the program. The evaluations and rankings are then used by the program administrator to make recommendations for funding the highest ranked proposals.

Before 2002, model systems (e.g., laboratory animals, cell cultures, computer models, etc.) required only modest additional justification relevant to the program description in the request for applications (**RFA**). In FY 2002, language was added to the RFA that required all models systems to be thoroughly justified in terms of program guidelines and relevance to US animal agriculture. To further increase the relevance of the Animal Reproduction Program to animal agriculture, the RFA was revised in FY 2005 to indicate that the program would no longer accept proposals that primarily (emphasis on primarily) utilize nonagricultural or nonaquacultural species as animal models beginning in FY 2006. This language does not preclude the use of nonagricultural or nonaquacultural species as animal models in applications to the Animal Reproduction Program as long as at least 50% of the proposed research involves agricultural or aquacultural species, including in vitro systems (e.g., cell lines) derived from agricultural or aquacultural animals. This restriction was announced over a year before it was implemented in order

to give the scientific community sufficient time to adjust to this important change.

INCLUSION OF PRIORITIES FOR INTEGRATED PROJECTS IN ANIMAL REPRODUCTION

In FY 2003, Congress authorized expenditure of up to 20% of funds appropriated to the NRI to support projects that integrated at least 2 of the 3 functions of research, education, and extension. Subsequently, Congress authorized funding support for integrated projects of up to 22% of the NRI's appropriated funds in FY 2006. In FY 2004, the Animal Reproduction Program solicited proposals for integrated projects that were directed at the growing problem of infertility in dairy cattle (Royal et al., 2000; Lucy, 2001). Priorities for integrated research, education, and extension projects were subsequently expanded to include the problems of infertility in dairy cows and broiler breeder chickens or seasonal infertility in swine in FY 2005 and to include infertility in any agricultural or aquacultured species the following year. The program funded its first integrated project in FY 2005.

FUNDING PRIORITIES FOR RESEARCH IN ANIMAL REPRODUCTION

As occurs for all NRI programs, funding priorities in Animal Reproduction are established by the national program leader overseeing the program. Development of the funding priorities involves obtaining and analyzing input from stakeholders, as well as routine consultation with other national program leaders in CSREES. The funding priorities are then approved, after any necessary revision, by administrators within CSREES, and published subsequently in the RFA.

Before 2004, funding from the NRI Animal Reproduction Program supported a wide range of projects encompassing almost every subdiscipline in reproductive biology of agricultural animals, including aquatic species important to the aquaculture industry and laboratory animals. For example, the FY 2003 RFA solicited proposals for innovative research on 1) ovarian function, including follicular development, ovulation, and formation/function of the corpus luteum; 2) reproductive function in males; 3) gamete physiology, fertilization, and cryopreservation; 4) in vivo embryonic survival, embryonic-maternal interactions, and implantation; 5) placental function, including causes and remediation of early embryonic loss; 6) parturition, postpartum interval to conception, neonatal survival, and puberty; 7) development of the embryo, placenta, fetus, and reproductive tissues/organs, and 8) emerging reproductive biotechnologies, including culture methods for optimal in vitro production and development of embryos and nuclear transfer. Research proposals emphasizing new technologies or strategies to enhance reproductive efficiency with immediate application to the animal agriculture or aquaculture industries were also encouraged.

During FY 2004, CSREES administrators directed all NRI programs to narrow the focus of funding priorities to 3 to 5 high-impact areas. Part of the impetus for this change was provided by federal efforts to implement performance-based budgeting (US Office of Management and Budget, 1993) and by the prediction for substantial reduction in budgets for most federally funded, nondefense research and development during 2005 to 2009 (American Association for the Advancement of Science, 2004). Accordingly, the NRI Animal Reproduction Program narrowed the focus of research priorities in FY 2004 to the following 5 areas: 1) identifying and ameliorating the causes of infertility; 2) basic mechanisms regulating fertility; 3) cryopreservation of gametes and embryos; 4) reducing the postpartum interval to conception; and 5) sterilization methods or development of monosex populations. Further focusing of research priorities occurred in FY 2005, with applicants invited to apply for grants in the areas of 1) infertility; 2) basic mechanisms regulating fertility; 3) cryopreservation of gametes and embryos, and 4) sterilization methods or development of monosex populations.

In FY 2006, funding priorities for research in the Animal Reproduction Program were again revised to subdisciplines that cut across all livestock, poultry, and aquaculture species and were focused further to the following 3 priorities: (1) gonadal function and production of gametes; (2) pituitary-hypothalamic function, and (3) embryo and conceptus development, including interaction between the conceptus and uterus. These changes were made, in part, based on recommendations that emerged from the Stakeholder Workshop on Funding Priorities in Animal Reproduction that CSREES conducted at the 37th Annual Meeting of the Society for the Study of Reproduction in Vancouver, Canada, on August 1, 2004 (Mirando and Hamernik, 2006).

CHANGES IN AWARD SIZE AND DURATION

In FY 2000, the Animal Reproductive Efficiency Program made 20 standard research awards, which averaged $187,835 (Figure 2) for 2.4 yr of support. The average award size was 63% of the average budget requested in those proposals. This reflected the philosophy of reducing budgets for individual grants in order to make a greater number of awards. In turn, awardees that received budget reductions of greater than 10% of the proposed budget were permitted to alter the scope of the project by modifying or omitting some of the objectives proposed originally. As a result, the objectives of awards often differed substantially from those of the proposals that originally were evaluated. Moreover, reductions to award budgets typically reduced the duration of the award, thus requiring applicants to resubmit renewal proposals within a shorter time interval.

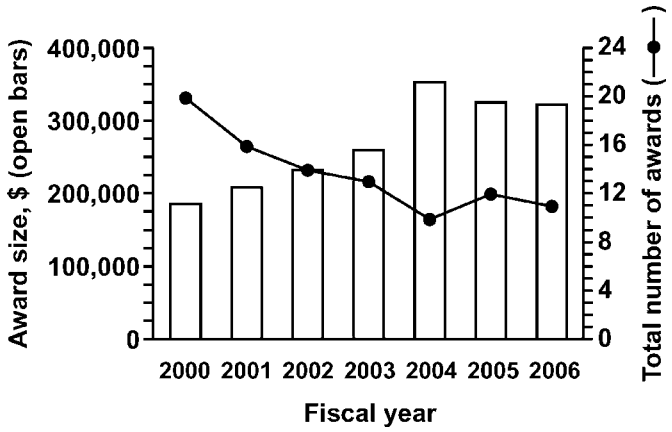

Figure 2. Average award size (open bars) for individual standard research grants and integrated project grants and the total number (filled circles) of standard research awards and integrated project awards made by the National Research Initiative Animal Reproduction Program during fiscal years 2000 through 2006. Data for fiscal years 2005 and 2006 include one integrated project grant funded in each year in the amount of $367,806 and $449,907, respectively.

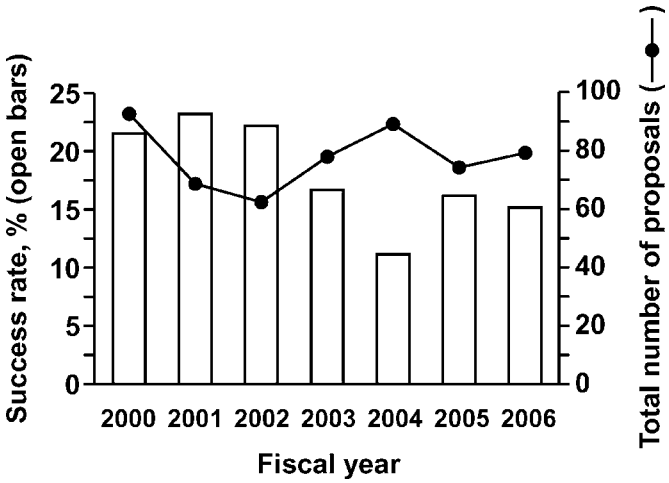

Figure 3. Success rate (open bars) and total number (filled circles) of standard research awards and integrated project proposals submitted to the National Research Initiative Animal Reproduction Program during fiscal years 2000 through 2006. Data for fiscal years 2004 through 2006 include 2 integrated project proposals submitted in 2004, 2 submitted in 2005, and 6 submitted in 2006.

During the subsequent 3 years, a programmatic effort was made to increase funding amounts and durations of grant awards made in the Animal Reproduction Program, consistent with recommendations provided in a National Academy of Science report to increase the size of NRI grants to an average of $100,000 per year (total costs) and award duration to 3 yr (NRC, 2000). Average amounts of funding for individual standard research grants (excluding new investigator awards and standard strengthening awards) increased to $209,673, $233,036, and $259,846 (Figure 2) for 2.6, 2.8, and 3.0 yr of support during FY 2001, 2002, and 2003, respectively. The average award size, as a percentage of the average budget requested by the applicants, increased from 77% in FY 2001 to 88% in FY 2003.

Language in the NRI FY 2004 RFA increased the maximum budget for proposals to $500,000 and, for the first time, included a minimum proposal budget of $300,000. These changes resulted in a marked increase in award size to $352,634 for grants averaging 3.0 yr in duration in FY 2004 (Figure 2). However, average award size decreased to 79% of the budgets requested in those proposals primarily because the average budget request of proposals recommended for funding increased sharply to $452,733. The maximum budget for standard research proposals was decreased subsequently by language in the RFA to $400,000 in FY 2005 and to $350,000 in FY 2006, whereas the minimum budget requirement for proposals was eliminated in FY 2005. Average award size (Figure 2) was $333,700 for 3.0 yr of support in FY 2005 and $312,906 for 2.9 yr of support in FY 2006, which represents 90 and 89%, respectively, of the budget requested for those proposals. As a result of increasing award size and a relatively flat program budget, the total number of standard research grants awarded decreased from 20 in FY 2000 to 12 in FY 2006 (Figure 2).

The changes in number of grant awards and award size in the Animal Reproduction Program over the past 7 yr have occurred in the presence of fluctuations in the number of proposals submitted to the program, which showed no apparent consistent trend (Figure 3). Although number of grant awards declined from FY 2000 to FY 2002, success rate (number of awards ÷ number of proposal × 100%) remained relatively constant as a result of 32% decline in number of proposals submitted during that time (Figure 3). Success rate then declined sharply through FY 2004 because fewer grant awards were made and number of applications increased. Subsequently, success rate increased as a result of plateau in number of grant awards made and a modest decrease in submission rate.

SUMMARY AND CONCLUSIONS

The NRI Animal Reproduction Program has been in existence since the inception of the NRI in 1991. Whereas the program has evolved throughout its relatively brief history, the most significant changes have occurred since 2000. Among the most notable changes have been the focusing of priorities for research and inclusion of a priority for integrated research, education, and extension projects. Effective priority setting can be used to maximize the impact of limited financial resources, establish useful metrics to measure progress, and ultimately convince administrators and Congress

to increase investments in research. Inclusion of a priority for integrated projects also is expected to increase the relevance of the Animal Reproduction Program to US animal agriculture and aquaculture through increased transfer of technology to producers of animal products. In turn, it is anticipated that this will affect the rapidity with which problems relevant to animal agriculture and aquaculture can be solved. Relevance of the program is further enhanced through funding of projects with increased emphasis on use of animal species important for the animal agriculture and aquaculture industries, as well as through reduced reliance on and increased justification for the use of nonagricultural models. Finally, changes to size and duration of grant awards in the Animal Reproduction Program will allow grant recipients to pursue objectives as proposed in their original applications without restrictions imposed by arbitrary reductions to funding amount and project scope. Comments regarding the Animal Reproduction Program or any other NRI program may be submitted at any time by e-mail to RFP-OEP@csrees.usda.gov.

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